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Pension funds and Market Efficiency : A review.

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Abstract

The literature on the relationship between pension funds development and market efficiency has been flourishing in the past decades. In this paper we provide an updated review of the theoretical and empirical advances in this field of study, with particular focus on the effects that pension funds exert on labor markets, financial markets and economic growth.

Classificazione JEL: G23, J62, C23

Keywords: Pension funds, Job Mobility and Labor Force participation, Capital Markets

1 Introduction

The ageing of world population and the related demographic transition are expected to produce major macroeconomic consequences in the next decades (see Batini et al. 2006). In particular, such a demographic shift is likely to bring about an increase in the amount of resources and transfers managed by traditional PAYG schemes, which, although with few exceptions, typically provide pension promises that are high in many countries, even for high earners[1]. For these reasons several developed and developing countries have undergone major reforms, especially in the last 20 years, aimed, on one side, at securing the long run sustainability of the mandatory, PAYG pillar and, on the other side, at fostering complementary, private forms of saving for retirement through the development of pension funds. A common trend of such reforms has been also the move from defined benefit to defined contribution schemes[2], both in PAYG and fully funded schemes, which has modified the risk profile of the household sector by exposing the employees' pension benefits directly to market risks.

After such intense changes, the issue of whether they have brought about improvements in terms of economic efficiency in the countries involved is of crucial importance, in that the answer will likely influence the path of reforms that are on the agenda of many governments.

Indeed, in the recent past a promising strand of literature concerning pension funds, market efficiency and economic growth has been flourishing.

As for the labor market, for example, various studies indicate that the incentives entailed in pension formulas may play a crucial role in affecting the decision of workers to quit some firms or to stay within others for a longer time period. Moreover, the same incentive structure is likely to influence the workers' decision to retire, thus affecting labor force participation rates. Finally, some workers may have a higher preference for current income over future retirement benefits and thus tend to avoid companies with pension plans. In short, considerable research suggests that pensions (indeed, either public or private) do play a role on the labor market outcomes, in that workers apparently behave as though they understand and respond to the financial incentives embedded in many pension plans[3].

On the financial market front, several scholars have argued that pension funds play a pivotal role in capital market development and in triggering economic growth, through several channels such as by increasing savings both at individual and national level, by increasing the availability of long term capital, by improving corporate performance and by lowering volatility in capital markets.

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[1] See, for example, OECD (2011), pp. 119 and 155. The exceptions in EU are Denmark, Netherlands, Ireland and U.K which are countries where PF are well developed.

[2] See OECD 2011, p.84.

[3] Such conclusions should be mitigated in the light of the findings that the empirical literature on financial literacy has brought to light. On this topic see the work by Lusardi and Mitchell (2011).

The purpose of this survey is to summarize the major insights from the most recent studies on pension funds and market efficiency and to identify topics for future research. Needless to say, any attempt to summarize what we learnt from this literature has to be selective and has to focus on a subset of topics to keep the project tractable. Hence, the present survey is restricted to the literature on economics of pension funds and its interconnections with labor and financial markets, while we will not cover such issues like the effects of pension funds on the efficiency of firms' management, on the stock market performance and on retirement planning adequacy. The interested reader can look at the existing works dealing with these topics. More precisely, as for firms' management efficiency, see, among others, Wahal (1996), Gillan and Starks (2000), Myners and Britain (2002), Coronado et al. (2003), Guercio and Hawkins (1999); as for the stock market performance, see Walker and Lefort (2002), Thomas et al. (2013) and the references covered therein. Finally, see Lusardi and Mitchell (2011) and Turner and Muir (2012) for the issue concerning pension funds and retirement planning.

The survey is organized as follows. Section 2 reviews the recent studies of pension funds and labor market efficiency, with focus on labor market mobility (subsection 2.1) and labor market participation (subsection 2.2.), respectively. Section 3 summarizes the debate concerning the relationship between pension funds and financial market efficiency. Subsection 3.1, 3.2 and 3.3 survey the literature on the impact of pension funds on saving, capital market development and economic growth respectively. Section 4 concludes.

2 Pension funds and labor market efficiency

Several authors have pointed out that pension funds (PF from now on) can affect labor market efficiency through several channels: first of all, the provision of occupational pension schemes can be used by firms as a means for signaling "better jobs", thus for attracting workers. Moreover, the regulation of pension portability and the type of formula used for computing pension benefits can influence workers mobility in the job market and their very participation to the labor force. We will review the literature on job mobility and on retirement decisions in subsections 2.1 and 2.2 respectively.

As for job mobility, from a theoretical point of view the issue of whether higher mobility of workers among firms is beneficial or detrimental for the efficiency of labor market and for the economy as a whole has been debated since long time. In fact, it goes without saying that the answer to such a question depends at least on two key elements: on the one hand, the economic model among the alternative views is recognized as better describing the actual functioning of the labor market and, on

the other hand, the distance that any economy under investigation displays from the ideal world depicted by such a model.

To all extent, it is reasonable to argue that there is a trade-off between workers mobility and efficiency, such that the conclusions on the most effective rules that should govern PF systems is an empirical matter. In the sections that follows we will recall some preliminary definitions concerning the pension schemes and the loss in portability of pension rights that are useful for a better understanding of the debate under investigation. Moreover, we will briefly sketch the theoretical background concerning the issue of pension's portability, mobility and labor market efficiency.

2.1 Pension funds and labor market mobility

2.1.1 Preliminary definitions

Pension benefits, either financed through PAYG or fully funded schemes, may be computed according to two methods: defined-benefits (DB) and defined-contributions (DC). According to the former the replacement ratio, that is the ratio between the pension and (an average of) last wages is fixed exogenously upon worker enrollment in the pension scheme; while, according to the latter mechanism, it is the contribution rate that is fixed from the beginning of contribution payments.

As a consequence, the main difference between the two schemes is the side that actually bears the risks entailed in the pension scheme, such as the internal yield volatility, the demographic and the political risk. In fact, in the DB scheme the internal yield is fixed by the contract, no matter the actual performance of the investments made by the pension institution that manages workers contributions. As a consequence, under such a scheme the worker is protected from negative events such as financial losses on investments, or financial unbalances due to contractions of subscribers or to the increase of life-expectancies of pensioners. All such risks, broadly speaking, are on the pension institution's shoulders.

On the contrary, under the DC scheme it is the worker that actually is burdened by the risks above mentioned. Another main difference between the two computation methods concerns the fact that DB schemes, differently from DC ones, are usually not actuarially fair, since at any point of workers lifetime, the discounted sum of the future pension payments is not equal to the capitalized sum of contributions paid. As a consequence, DB schemes typically bring about distortions of individuals decisions concerning, for example, the age of retirement or the amount of savings. On the other hand, DC schemes, being actuarially fair, are less distortionary and, thus, may provide gains in the efficiency of labor and financial markets.

Another important concept concerning economic incentives to mobility and labor market participation provided by PF is the so-called *portability loss*. The portability loss is the shortfall of retirement benefits stemming from the change in the pension scheme membership, typically due to a

change in job. The literature distinguishes at least four sources of portability losses which are summarized by Forteza (2010):

Vesting losses: If a worker leaves a job before completing the vesting period (i.e. the minimum years of service in the scheme required to receive the benefit) he/she gets no pension rights.

Final wage losses: As recalled above, many pension plans base computation of benefits on the last salaries. According to this rule, an early leaver (or early pensioner) will have a pension computed on the salary earned upon leaving the job (or retirement), which is going to be smaller than the salary at the end of a complete working career, if wages are growing with experience, or if there is inflation and wages used to compute the benefit are not "valorized", i.e. adjusted by inflation.

Back loading losses: Some DB pension schemes comprise increasing accrual rates: pension rights grow slowly during the first years in the scheme and start growing faster with seniority. Therefore, workers who switch jobs accumulate proportionally lower pension rights.

Penalties losses: Some pension schemes accept rights accrued in other schemes but with a penalty. Also some programs penalize pensions paid abroad, i.e. apply reductions to pensions paid to retirees who left the country.

We will see that empirical studies have addressed and found different roles for any of such losses in affecting job mobility. However, we also note that since most of these portability losses are comprised in DB schemes, it is argued that the extent of job mobility is significantly reduced under the latter plans.

In fact, in fully funded, private DC pension schemes, the vesting period is typically less long and most importantly annual pension accruals tends to be more uniform across years of service[4]. Thus, since workers typically are allowed to change their jobs without suffering high losses in their pension wealth, it is typically argued that benefits from DC schemes entail a higher degree of portability and may enhance labor mobility.

2.1.2 Theoretical background

As mentioned above, the degree of mobility among workers that a certain labor market should entail depends on which economic model and definition of economic efficiency one has in mind. Summarizing, the issue of the relationship between job mobility, portability of pensions and labor market efficiency is debated under two main viewpoints, namely the "implicit contract model" and the

[4] In the US, for example, most DC plans allow for the immediate vesting of employee contributions, while virtually all DB plans impose at least five years vesting.

"auction market model" (somehow in the middle can be considered the "search theory" initiated, among others, by Mortensen and Pissarides1994).[5]

A milestone of the implicit contract paradigm is the argument that productivity gains can be achieved through longer job tenure (Oi 1962; Lazear and Moore 1984; Ippolito 1991).[6] As a consequence, under this view, non-portable pensions would raise productivity by means of productive job matches, improving investments in workers through training activities (Becker 2009; Dorsey and Macpherson 1997; Andrietti and Patacchini 2004; Fella 2005; Delacroix and Wasmer 2006; Schrager 2009) or creating incentives to workers not to shirk or by using pensions as a commitment device (Lazear 1979; Gustman et al. 1993 ; Galdon-Sanchez and Guell 2003; Friedberg et al. 2006; Stahler 2008; Baumann 2010). Hence, according to such a view, the traditional DB design, producing less workers mobility, would be beneficial for the economy's efficiency, especially when firms face other significant hiring and training costs.

On the somehow opposite side there is the "auction model" or "spot market view" (see, among others, the work by Bulow 1982). Under such an approach any negative shock implying layoffs and quits allows workers to get reallocated to the highest valued employment, provided that job mobility is allowed. The theory argues that contemporaneous demand and supply conditions determine employee compensation, and the continuous equality of the wage and value of marginal product ensures the allocation of workers to their highest-social surplus in each period. According to such a theory workers are indifferent about the place of work and employers have no problem in replacing workers with others of equal skills. In this regard it is easy to understand how portability can be an important determinant of job mobility and, consequently, of labor market efficiency, because portability of pension rights are expected to enhance job mobility and to produce a better allocation of resources. As a consequence, under such a view non portable pensions are seen as a barrier to efficiency.

In fact, works on portability of pension rights and mobility under the "spot market view" are sparse and limited to studies including Ross (1958), Becker and Stigler (1974) and Choate and Linger (1986). They argue that in the face of changes in tastes or technology, total labor productivity is maximized when restrictions on job mobility are minimized. For example, Ross (1958) argues that non portable pensions would create industrial feudalism in which workers would be restricted to the same job profile and would be unable to respond to new opportunities, thus jeopardizing economic efficiency.

The issue reappeared in the 1980s, when Choate and Linger (1986) argue that non-portable pensions contribute to an inflexible U.S economy. In fact the authors state that "Weakness in pension availability, benefits and portability are now impeding the mobility that is so essential during this

[5] For a study on the relationship between pension choice and labor market in such a framework see the work by Corsini et al (2012).

[6] Such a view hinges on the argument that inefficiency in labor market results from too many quits, because workers and firms, engaging in long lasting relationships, involve multiple mutually beneficial inter temporal exchanges especially when monitoring workers effort is costly and imperfect. Consequently, it is argued that excessive turnover implying high job flexibility would deter such productivity enhancing process through training and development. For a pioneering work see Oi (1962).

period of economic and technological turbulence as an ageing work force avoids job changes to protect pension rights." (pp- 245)[7].

In fact, since the literature on pensions and job mobility in the past has been mainly focusing on the implicit contract view, which upholds a negative relation between job mobility and pension coverage, in the next section we will present the main empirical results of this strand of literature.

2.1.3 Review of the empirical literature

In sum, we can say that two main questions have been addressed by empirical studies on PF and job mobility.[8] first, does pension coverage per se limit mobility[9] and, secondly, does portability of pensions enhance mobility and thus labor efficiency? Needless to say, such questions are strictly interrelated, such that several times they have been addressed together, or more precisely, tested one against the other as alternative possible explanations of the empirical evidence.

In particular, as for the relationship between pension portability and job mobility, the empirical analysis has mainly concentrated on three main possible explanatory variables (either exclusive or concurrent), namely:

a) Portability losses;
b) Compensation premia, that is the wage that, according to the "efficiency wage theory" is paid in excess of the competitive wage in order to increase productivity;
c) Self-selection mechanism, where workers who are switch-prone select themselves into jobs with low mobility.

In the subsections that follow we will review the main results concerning the above mentioned elements. Moreover, due to data availability, the majority of empirical works have been carried out on the US and UK. Hence, we will focus on the contributions concerning such countries, and present recent results on some European countries in the final part of this subsection.

Portability losses and compensation premia

As for the portability losses, among the pioneering contributions, Ippolito (1987), using 1979 Current Population Survey, finds that low turnover rates among federal workers are to be attributed to

[7] Also Allen et al. (1993) undertook a study to examine the declining productivity levels in the industries and noticed that Ross's concern was relevant when there is a rapid structural change and shift in labor demand.

[8] For a previous review on this topic, see Dorsey (1995).

[9] Preliminary works on the first question, dating back to the late 1970s and early 1980s, have reported lower mobility rates for occupational pension covered workers (Bartel and Borjas 1977; Mitchell 1982; McCormick and Hughes 1984; Wolf and Levy 1984; Allen et al.1988).

unusually large pension capital losses comprised in DB pensions of federal workers relative to private sector pensions.

Similarly, Lazear and Moore (1988) argue that an employee approaching retirement is normally discouraged to leave the firm prior to the attainment of full pension benefits, and thus tends to wait the year in which the largest pension accrual (which they define as "pension option value") occurs. In particular, they find that turnover rates are predicted to be twice as high for workers without pensions as for those with the average pension.

On the other hand, Gustman and Steinmeier (1988), using the retrospective mobility data from 1983 Survey of Consumer Finances, explain lower mobility rates among pension-covered workers of the private sector in terms of compensation premia entailed in efficiency wages rather than to pension backloading.

Adding a new perspective to the back-loading of pensions Ippolito (1991) estimates the impact of the potential loss in pension wealth of DB participants and finds that quit costs amount to one year earnings at mid-career, which increases the tenure at age 55 by 20 percent. The author argues that imposing losses in pension wealth has a much greater effect on turnover than tilting the tenure/earnings profile.

However, the above argument of backloading of pensions causing job immobility is dismissed by Gustman and Steinmeier (1993), since they argue that mobility is lower in pensionable jobs, whether DB or DC. According to these authors, firms and workers engage in implicit contracts that reduce mobility because of monitoring and training issues. As a counterpart of the reduced mobility, workers receive a "compensation premium" in terms of higher wage levels. Hence, they argue that firms that offer pensions are also those tending to pay higher wages. They carry out an analysis using the Survey of Income and Program Participation (SIPP) data and find that it is not the portability but the higher compensation workers obtain under pension-covered jobs which accounts for lower turnover.[10]

On the other hand, Ippolito (1994) argues that the wage premium models fail to consider the supply conditions faced by firms whose workers attain longer tenure. He finds that firms pay a price (indenture premium) for attracting workers who plan to remain with the firm and that it is this premium that attracts workers with low quit propensities rather than the efficiency wage that affects turnover.

More recently. a study by Lluberas (2008), somehow in contrast with previous literature, presents evidence of the different effect that DB occupational pension schemes have on job mobility relative to fully funded DC pension schemes. More precisely, using data from the two available waves of the English Longitudinal Study of Ageing (ELSA) the paper focuses not only on the effect of pension provision on employee turnover, but also on the possible different behavior of workers in DB and those in DC occupational pension schemes. By applying a probit model with sample selection for the probability of employee turnover, the results confirm that pension covered workers tend to have

[10] In the words of Gustman and Steinmeier (1993) "Pension covered jobs offer higher levels of compensation than workers can obtain elsewhere, and it is this compensation premium, rather than non-portability that accounts for lower turnover among workers covered by pensions" (p. 316).

lower turnover rates than non-covered workers. Additionally the author finds that not only coverage but type of pension is a key determinant in explaining job mobility, thus confirming that DC members are more mobile than DB peers and suggesting that the low portability of pension rights could be an impediment to job mobility.

Self-selection

The more general argument that self-selection of workers is the reason for lower turnover of workers has been put forward by several scholars. This strand of literature focuses on the positive association between length of job tenure and pension coverage, allowing for the possibility that pension scheme members are less mobile than other workers because they have persistent unobserved characteristics that predispose them towards a high degree of security in both employment and retirement. The key idea of this view is that pension portability losses act both as a mobility deterrent for pension covered workers and as a self-selection device, inducing stable workers to join pension covered jobs, thereby screening out workers who are likely to quit.

For example, Allen et al. (1993)[11] introduce self-selection as a further explanation to observed mobility rates among pension covered workers. They use a simultaneous equation model to show that unobservable employee characteristics can explain both higher job turnover as well as coverage by a pension plan.

Disney and Emmerson (2002) provide evidence of sorting into pension-scheme types depending on mobility characteristics in the U.K. Exploiting the unique dataset of British Household Panel which clearly differentiates between choice of actual pension arrangement by the individual and what pension arrangements were offered to that individual, the paper finds that workers who are more mobile select pension arrangements that a priori impose lower costs on job mobility like private pension arrangements. Thus, workers who purchased any private pension, instead of remaining in occupational pension schemes**,** have higher mobility rates. This pattern suggests the presence of some selection processes, whereby individuals who make active pension arrangements for the future (and, therefore, have lower discount rates) may also have more stable job tenures.

Ippolito (2002) argues that in the U.S., jobs with "deferred wages" are used to distinguish savers from other types of workers. He argues that such characteristic gives more predictability of mobility behavior and supports the notion that selection is more important than the incentives in explaining quit behavior. As the savers are typically better workers than non-savers, firms tend to pay them higher wages and thus lower turnover among such workers emerges.

In order to offer a cleaner estimate on the causal effect of pensions on labor market transition, empirical studies have tried to correct for the selection of less mobile individuals into jobs that offer a

[11] Also see Allen et al. (1988), who studied the impact of portability losses in quits and layoffs, concluding that the effect on the latter is also relevant, as firms want to avoid the reputation risk of not keeping the implicit contract of pension-deferred compensation.

pension. Examples are the inclusion of random effects (Mealli and Pudney 1996) and the use of instruments for occupational pension coverage as performed in Andrietti (2004). Andrietti (2004) analyzes voluntary separations of private sector male employees in the UK using a hazard modeling framework, in order to evaluate the impact of second tier pension schemes choice and portability rules on voluntary job mobility. Again, when controlling for the potential endogeneity of pension choice the author finds that the observed negative relationship between occupational pensions and quits is due to unobservable traits such as lower discount rate or better quality of jobs as proxied by higher wage rate.

More recently, Haverstick et al. (2010) undertake a study in the background of the argument that increased job mobility is the major reason for the shift of workers from DB to DC plans in the U.S economy. Using data from the Survey of Income and Program participation (SIPP) and panel study of Income Dynamics (PSID), through a duration analysis they observe that workers with 5 to 10 years of tenure at a firm are 23% more likely to leave the firm with a DC plan than a DB plan. Moreover, the effect of pension types differs for workers at different stages of their respective carrier and this difference is consistent with the differences in the timing of benefit level entitlement between the two types of plan. Finally, certain firms within industry may offer a DC plan as they foresee that some workers tend to be mobile by nature. In short the results are consistent with the notion that DC workers take advantage of the pension portability during the middle of their tenures at a particular firm and that self-selection plays a role.

Cocco and Lopes (2011) empirically study individual pension choice between different pension plans (i.e. DB state plan, fully funded private plan and occupational pension plans) in U.K. They relate labor income characteristics to the choice of pension plan. Employee characteristics along with job tenure are found to play an important role for deciding which pension plan to choose. The study argues that apart from the worker characteristics, workers decision to contribute to a personal pension instead of an occupational pension scheme depends on the duration of tenure. In the analysis it is found that individuals with shorter job tenure are more likely to contribute to a personal pension. Variables like labor income, savings and homeownership additionally explain pension choice. They also observe the presence of sorting of workers into different plans through the self-selection mechanism.

Finally, Goda et al. (2012) provide new insights into the effect of the widespread transition from DB to DC pension plans on employee mobility. The study tries to quantify the role of selection by exploiting a natural experiment at a single employer in which an employee's probability of transitioning from a DB to a DC plan is exogenously affected by the default provisions of the transition. Using a differences-in-regression-discontinuities (DRD) estimator, they find evidence that employees with higher mobility tendencies self-select into the fully funded DC plan. Furthermore, a negative direct effect of DC enrollment on turnover is witnessed within one year. The results suggest that selection is likely to contribute to an observed positive relationship between the transition from DB to DC plans and employee mobility in settings where employees choose plans or employers.

Recent works on European countries

As seen so far, most research has been mainly carried out for U.K and U.S. However there are few empirical studies on some European countries.

Andrietti (2000) is among the first comparative studies discussing the issue of portability of pensions in occupational pensions and its effect on job mobility. Similarly to previous studies on different countries, the author observes lower turnover for occupational pension workers than uncovered workers in Denmark, Ireland, UK, Netherlands. However, even controlling for selection bias due to unobservable, simultaneously affecting prospective wages and job mobility choices, he finds no evidence that the potential pension portability losses deter job mobility: the results suggest that DC pension plans, despite their full portability, negatively correlate to labor mobility as much as DB plans. The paper extracts evidence of compensation premia accruing to workers in pension, union and health-insurance covered jobs and thus supports the view that workers are less likely to leave good jobs. As in Gustman and Steinmeier (1993), these results undermine the argument that the lack of pension portability is a key factor in explaining the lower mobility rate observed among workers in pension covered jobs.

Rabe (2007) argues that pension covered workers in Germany are three times less likely to change jobs than the workers not covered by occupational pension scheme. They estimate the effects of occupational pension coverage and pension portability loss on voluntary job changes using a sample selection model with endogenous switching. Using data from German panel from 1985-1998, the authors show that pension coverage deters voluntary job transitions by imposing a capital loss on both vested and non-vested early leavers. Furthermore, workers in pension covered jobs receive a compensation which is about 10-12 % higher than in jobs not covered by pensions. Compensation premia make mobility from pension jobs less attractive, and workers face less outside opportunities for better jobs. Additionally, sorting of stability-oriented workers (which is proxied by home ownership) plays a significant role in reducing mobility. In short, the stylized arguments of compensation premium and self-selection act together to prevent high workers' turnover.

Recently, a study on portability loss and job mobility has been carried out by Hernaes et al. (2011) which develops a new method for measuring the potential portability gain or loss in DB pension schemes.[12] Using the Norwegian national register data for three distinct periods (1997-1999, 1999-2001 and 2001-2003), the authors show there is no lock-in effects of occupational pensions in Norway in any of the time periods investigated. In fact, most workers found the mobility losses in pensions to be moderate. Their empirical analysis shows that the effect of potential portability gain on the propensity to job change is low and could be offset by a rise in the wages. Hence they conclude that in Norway labor market mobility is not affected by occupational pensions characterized by high portability costs.

[12] Such an indicator is the change in the pension entitlement incurred by a person moving to another firm with same pension type and same future wage trajectory.

Finally, Fonte-Santa and Gouveia (2011) assess the impact of occupational pensions on mobility rates for the Portuguese case. Using a sample of more than 850.000 Portuguese private workers for the years 2007 and 2008, they observe that mobility rates of covered workers are half of the mobility rates of non-covered workers. The estimations also observed that covered workers face lower potential wage gains from mobility and find no role for portability losses in explaining the mobility differentials between occupational pension covered and non-covered workers. Hence, according to such a study pension covered jobs seem to be better jobs and the latter seem responsible for lower mobility due to the lack of good outside options.

Table 1. Summary of main findings on pension funds and job mobility

Author/ country	Periods Covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Andrietti (2000) / Denmark, Ireland, UK, Netherlands	1995-1996/ European Community Household Panel	Pension portability and job mobility	Switching regression econometrics and Probit Estimates	Occupational pensions are not repressing mobility. Internationally need to differentiate DB and DC plans.
Disney and Emmerson(2002)/ U.K	1992-1998 / Household Panel Study	Choice of pensions and job mobility	Probit model	Employees with private pension have lower mobility rates than others, due to self-selection mechanism. Moreover, purchase of a (fully portable) private pension is associated with workers who have less 'forward looking' behavior which reflects longer job tenures.
Andrietti (2004)/ United Kingdom	1991,1995,2000/ British Household Panel data	Choice of pensions and job mobility	Duration Analysis, Instrumental Variable hazard model	The effect of occupational pension on job mobility is not statistically significant.
Rabe (2007)/ Germany	1985-1998/ (SOEP) Annual Longitudinal Survey of Private Individuals	Pension plan and job mobility	Reduced form probit model	Occupational pensions plan coverage deters mobility. Loss of vested benefit and compensation premium cause lower mobility. Sorting of stable-workers is associated with reduced job mobility.
Lluberas (2008)/ U.K	March 2002- March 2003 and June 2004 to July 2005/ English Longitudinal Study on Ageing	Pension plans and job mobility	Probit model and Matching models	Fully funded DC members are more mobile than traditional DB scheme subscribers. Low portability of pension could be impediment to job mobility.

Continued

Author/ country	Periods Covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Haverstick (2010)/U.S	1996-2001/ PSID and SIPP Panel	Pension portability and job mobility.	Duration analysis	Workers with DC schemes are 23% more likely to leave a firm. Job mobility differs at different stages of the career and workers take advantage of portability gains/losses of pension during their tenure.
Fonte Santay and Gouveia (2010)/ Portugual	2007-2008/ Quadros de Pessoal Portuguese Ministry of labor and social solidarity.	Occupational pensions and mobility rates	Rare events logit model	Occupational pension covered workers face lower potential wage gains from mobility. No role for portability losses in explaining the mobility differentials between covered and non-covered workers. More portable pensions would not affect job mobility.
Hernaes et al (2011) / Norway	1997-1999, 1999-2001 and 2001-2003 / Statistical Office, Norway	Occupational pensions and Mobility	Probit models	No portability loss/gain in occupational pensions is influencing labor mobility
Cocco and Lopez (2011)/ U.K	1991-2000/ Family Resources Survey	Choice of pension plans and worker turnover	Multinominal Logit	Workers who prefer shorter job tenure contribute to private pension systems. This is due to the lower portability cost compared to occupational pension plan.
Goda et al (2012)/ U.K	1999 to 2005/ Annual pension accruals of teachers	Choice of pension plans and job mobility	Difference in regression discontinuities estimator (DRD)	Employees with higher mobility tendencies self select into a private DC plan.

2.2. Pension funds and retirement timing

Another relevant issue concerning the link between labor market efficiency and PF is the effects that the latter might exert on the timing of retirement decisions.

We recall that retirement choices and pension incentives have been studied both under static and dynamic framework.[13] In the former framework, the worker is not bothered by the future, as the solution to the retirement problem is based on current period variables or in other words is merely an allocation between consumption and leisure in a given time period. On the other hand, the dynamic approach hinges on the idea that the retirement choice has an intertemporal nature and is undertaken by rational and forward looking individuals who aim at maximizing their life-time utility. Hence, under this view, individuals take care not only of the current variables, but also of the future ones, which are typically uncertain in nature.

In fact, such a literature mainly concentrated on DB schemes, whether public or second tier retirement plans, while the analysis of the effects of DC schemes, and in particular supplementary private PF, is still embryonic.

We start by briefly recalling the main results on DB schemes in 2.2.1 and reviewing the literature on PF in the subsection 2.2.2.

2.2.1 Research on PAYG or mandatory-DB pension schemes: overview

A substantial literature in labor economics in the last three decades has focused on the effects of incentives entailed in DB pension systems on the timing of retirement decisions[14]

As for the microeconomic analysis, two separate tracks have been followed: the first channel consists in using the details of specific employer pension plans, using administrative records and plan provisions for each worker across time. The advantage here is that the researcher can calculate exactly the pension incentives designed for workers in each firm; for example, how pension wealth would change if an employee with a given earnings history worked for another year. The alternative approach that has been followed is to use employer reported data obtained from longitudinal surveys conducted by various organizations. For example, in U.S. large micro data sets are available, such as the Survey of Consumer Finances (SCF) and Health and Retirement survey (HRS), the Panel Survey of Income Dynamics, (PSID). This method solves the problems faced when using the data from the single employer[15] and, moreover, allows for the use of data that are nationally representative and contain socio-demographic information on workers.

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[13] See Spataro (2005a) for a review on these methodologies.

[14] Early evidence about retirement effects originated in case studies of employer plans (Kotlikoff and Wise 1987; 1989; Stock and Wise 1990a; Lumsdaine et al. 1992; Ausink and Wise 1996). The above mentioned studies underline that DB pension incentives were often substantially sharper than any other pension scheme. See also Ippolito (1998).

[15] These limitations are concerned with the lack of availability of data in public domain as most firms or organizations do not share such information. Secondly, these data sets typically contain only the most rudimentary demographic information about the workers and usually do not contain important variables such as health, wealth, and family characteristics. In addition, the workers in these plans cannot be considered as a representative sample of all workers covered by pensions.

The seminal contributions on retirement choices and economic incentives entailed in pension systems were carried out in a static framework, such as in Feldstein (1974); Sheshinski (1978); Diamond and Mirrlees (1978); Boskin and Hurd (1978). Although econometric advances were made in pension/retirement analysis, much empirical work was limited due to non-availability of data as most of the data sources were self-reporting and therefore scope for mistakes was higher. Studies using reliable data sources based on US data have later addressed the issue of declining labor market participation of older workers stemming from the retirement incentives and social security wealth.[16]

In particular, such studies have analyzed retirement as a decision taken by forward looking individuals and have employed the concept of option-value coined by Lazear and Moore (1988) and later popularized by Stock and Wise (1990b) and Lumsdaine et al. (1994) to study the effects of DB pension plan provisions on the retirement choice. The option value approach assumes that the worker assesses and understands the full future path of pension accruals when deciding her/his retirement age. As this structural model is difficult to implement, numerous authors (e.g. Asch et al. 2005; Ausink and Wise 1996; Samwick 1998; Hakola 2002; Gruber and Wise 2000) have used the option value in reduced form models. Though dynamic programming models, produced, among others, by Burkhauser et al. (2004), involves the advantage of assessing the dynamics of choices over time, the need of highly complex computation (without offering a better predictive power when compared with the option value), represents a disadvantage of such a method.

Another measure of financial incentive influencing retirement decisions developed by Coile (2004), often used at the RHS of reduced-form equations, is refereed as Peak Value. Later studies by Coile and Gruber (2007); Friedberg et al. (2005) used the Health and Retirement Study (HRS) data in U.S, while Asch et al. (2005) used administrative data from Ministry of defense, while Friedberg and Turner (2010); Furgeson et al. (2006) used the Teacher follow up survey (TFS) to employ the "peak value method". Although its application has been predominantly within DB plan frameworks, it has also been used to model the behavior of DC participants.

Moving to the macroeconomic studies, there are studies supporting the argument that retirement incentives embedded in the pension systems were primarily responsible for the lower labor participation among older workers, however they were mostly restricted to DB public schemes of industrialized countries (Blondal and Scarpetta 1997; Gruber and Wise 2008). In a nutshell, pooled cross-country time series regressions suggest that the variation in participation rates across countries and time can be explained by various features of old-age public pension systems, including the replacement rates, the standard age of entitlement to pension, and the accrual rates. Additionally, the macro studies pointed out that other socio-economic variables, such as the degree of labor market

[16] For a review see Hurd (1990) and Brinch et al. (2001). For cross country comparison studies see Gruber and Wise (2000); Lumsdaine and Mitchell (1999) for U.S. and Borsch-Supan (2000) for Germany, Blundell et al. (2004) for the U.K, Spataro (2005b) for Italy, Hanel and Riphahn (2012) for Switzerland, Palme and Svensson (2004) for Sweden and De Vos and Kapteyn (2004) for Netherlands. While positive relation is found by Moffitt (1987) for U.S. and Baker and Benjamin (1999) for Canada, Heyma (2004) for Netherlands finds limited influence of economic incentives.

protection, level of national wealth, unemployment benefit, spouses retirement timing, could also have played a role in reducing participation rates (Duval 2003; Fischer and Sousa-Poza 2006).

2.2.2 Review of empirical works on DC plans

As anticipated, the studies on DC or fully funded private pensions (PF) are embryonic and we were able to select four relevant contributions.

The question of retirement timing under a pension reform has been addressed by James and Edwards (2005). Along the lines of Coile and Gruber (2004) (and later, of Gruber and Wise 2008) they argue that while most DB schemes contain incentive that encourage early retirement, the tight link between the contributions and accumulations and the actuarial conversion of accumulations into pensions in privately managed DC schemes may lead workers to voluntarily postpone retirement. The argument is based on the empirical results from Chile, which has changed its social security system from a PAYG to a fully funded DC system in 1981. Using a household survey representative of 2,500-3,000 households, from 1957 to 2002, the results of the probit exercise find a positive and significant effect of the pension reform on labor force participation of older workers.[17] Additionally the paper points out that effects were larger for workers who were younger on the date of the reform and that the workers of the younger age group were more likely to switch to the new system.[18]

More recently, the work by Manchester (2010) uses the Retirement Confidence Survey of College and University Faculty, carried out in 2005, to examine the impact of pension plan incentives on retirement age and to understand the retirement timing pattern of workers due to the transition from a DB to a fully funded DC scheme. This study finds that faculty in a DC plan expect to retire eight months later on average, relative to those in a DB plan. When preferences are taken into consideration, the career length increases along with the effect of incentives: individuals who choose to enroll in a DC plan expect to retire sixteen months later than those who chose to enroll in a DB plan. Additionally, financial literacy and fiscal position also have a sizable effect: those who are more financially literate expect to retire one year later as do individuals unburdened by debt.

Ni et al (2009) estimate a structural model (i.e. the option value model) of individual teachers to evaluate the effect of pension enhancements on a DC plan using administrative data for Missouri teachers aged 50-55 at the beginning of the 2002-03 school year[19]. The study finds that teachers at or near the "peak value" of pension wealth, find DC plan more attractive as it eliminates the penalty on

[17] The study attributes the increased labor supply of older workers to: 1) Postponed pension age because of tighter early withdrawal preconditions and actuarial fair linkages between contributions and benefits; and 2) Increased incentives to continue working even if pensioned, because the new system eliminates work penalties that existed previously and exempts pensioners from the pension payroll tax.

[18] Workers newly entering the labor force were required to join the new system. Older workers were given the option to switch, with recognition bonds compensating them for their contributions to the old system. Switching propensities were high and inversely correlated with age (see Palacios and Whitehouse 1998); Acuna and Iglesias (2001) note that by 1983 77% of all covered workers had switched to the new system, including most workers under age of 50.

[19] The Missouri legislature passed a series of pension enhancements during the 1990s. Between 1992-93 through 2000-01, one or more rule changes were implemented which increased teacher pension wealth. Ni et al. (2009) had estimated that the aggregate peak value pension wealth of the 2007 teaching workforce increased by roughly four billion dollars due to these enhancements.

working after reaching the peak value. Finally, the optimal timing of the retirement under the fully funded DC depends on the teachers age, experience, and the initial pension wealth lump sum payment. However, it is noted that under the fully funded DC plan, the teaching survival rate declines much more slowly than under the two DB plans, regardless of the retirement in initial years. The simulation they carry out suggests that at the end of the forecast period, about 7% of the teachers are predicted to remain teaching under the DC plan, while around 1% are predicted to do so under the DB rules.

Finally, MacDonald and Cairns (2011) carry out a Monte-Carlo simulation study to understand the hypothetical retirement behavior of DC plan participants. The study develops three retirement models namely an option value model, a two- third retirement model (i.e. a “rule of thumb” criterion on the replacement rate) and finally a “one-year” (i.e. myopic) incentive model, with different specifications to capture the retirement timing. The authors find that the myopic model is the closest to accurately capture a DC participant’s approach to retirement. The simulations also show that, owing to the age-neutral pension accruals of DC plans and the implied influence of wealth on a DC participants choice to retire within all three models, retirement is smoothly distributed over a substantial range of ages, and the magnitude of the range is a direct result of the uncertainty in the financial market.

Table 2: Summary of main findings DC pension funds and Retirement Decision

Author / Country	Periods covered/Data Source	Topics Investigated	Methodology Used	Major Findings
James and Edwards (2005)/ Chile	1957-2002/ Household survey data	Pension funds and retirement timing.	Reduced Form Probit model	Conversion to fully funded DC scheme in Chile has increased the labor force participation of older workers.
Ni et al (2009)/ U.S.	Simulations based on data of 9605 teachers aged between 50-55 in years 2002-03	Fully funded pensions and retirement timing	Simulation study Probit model	DC models delay retirement age and smoothen out of the retirement pattern.
Manchester (2010)/ U.S	March to May 2005 telephonic interview/ Retirement Confidence Survey of College and University Faculty	Pension choice and retirement expectations	Reduced Form Probit Estimates	Difference in plan incentives along with career preferences create additional years of work among workers. Financial literacy and fiscal position also determines retirement timing.
Macdonalds and Cairns (2011)/ U.S	2002-03 to 2008-09/ Administrative data for Missouri teachers	Teachers' pension choice and retirement age	Option value, Monte Carlo Simulations	Fully funded DC plans eliminates the worker penalty when worker reaches the peak value of pension wealth. Survival rates declines more slowly in a fully funded scheme then in DB scheme.

Section 3: Pension Funds and Financial Efficiency

Several authors have argued, both theoretically and empirically, that funding of pensions can have considerable impact on the efficiency of financial markets and, indirectly, on economic growth.[20] According to such a strand of literature, fully funded PF can stimulate both capital market efficiency and economic development by providing higher amounts of resources through more efficient channels. This view has been particularly influential in recent decades, inspiring both recommendations by international institutions and actual reforms of pension systems throughout the globe. In fact, such reforms were aimed at insuring the long run sustainability of the first pillar (PAYG) and at increasing the role of PF, under the idea that the accumulation of PF assets would definitely encourage aggregate savings and, through this channel, economic development (Edwards 1996; Bailliu and Reisen 1998; Kohl and O'brien 1998; James 1998; Schmidt-Hebbel1998; Morande 1998, Marè 2011).

In what follows we review the literature, both theoretical and empirical, concerning the role of PF in the fields mentioned above, starting from the argument that PF could bring additional resources to the economy via higher savings. We then focus on the capital market development and on economic growth.

3.1.1 Empirical evidence on Pension funds and saving

The issue of estimating the effects of mandatory pensions on savings has been largely studied, both under PAYG and funded schemes.[21] As for the latter, we can say that the conclusions from the empirical literature have been mixed, abstracting from methodological differences arising from either regression-specification and/or data. We will start by presenting the works on time series data, and then we will lay out those on panel data.

Time series studies

The pioneering works which looked at the effect of private pensions on savings were time series studies by Cagan (1965) and Katona (1965) who have shown that employees covered by private pensions do not save less and may even save more than employees not covered by private pensions. Cagan (1965) interpreted the results in terms of "recognition effect" that is the fact that the introduction of funded pension schemes increases the awareness to save for retired life. Katona (1965) offered a different explanation for the phenomenon based on the psychological theory that one increases her effort when she is closer to her goal. Thus PF savings bring individuals closer to their retirement

[20] For theoretical studies on the link between financial markets and economic development see Bencivenga and Smith (1991); horizontal cross analysis includes, among others, King and Levine (1993); Levine and Zervos (1998); Beck and Levine (2004); international analysis comprises studies by Rajan and Zingales (1998); Demirguc-Kunt and Maksimovic (1998).

[21] For studies discussing the effect of social security wealth under DB and PAYG on savings see Feldstein (1976); Feldstein and Pellechio (1979); Feldstein (1996); Kotlikoff (1979); Leimer and Lesnoy (1982) for U.S, Jappelli (1995); Attanasio and Brugiavini (2003); Bottazzi et al. (2006) for Italy, Attanasio and Rohwedder (2003) for U.K Dicks-Mireaux and King (1984) for Canada and Alessie et al. (1997); Euwals (2000) for Netherlands, Yamada and Yamada (1988) for Japan, Koskela and Viren (1983); Dayal-Gulati and Thimann (1997).

income and make them intensify their effort to reach the desired level of consumption by increasing personal saving.

Several countries in Latin America[22] have begun a transition from PAYG to funded systems, based on the example of Chile in 1981 (see Schwarz and Demirguc-Kunt 1999; Schmidt-Hebbel 1998). Such reforms have represented a sort of natural experiment on which much research concerning the effects on savings has been carried out.

Preliminarily, it is worth say that a key aspect of the aforementioned reforms has been how governments decided to finance existing social security obligations along the transition of the phasing in period. In fact, as argued by Holzmann (1997) focusing on the case of Chile, the possible positive effect of PF growth on personal savings could be offset at the level of national saving by the impact on public finances of the costs involved in the transition to a privately funded system, in terms of higher debt burden and/or higher tax subsidies to personal saving. If the government tries to finance the implicit pension promises by issuing extra public debt, then public savings would decrease, so the overall national saving rate might be unchanged or even fall.

Schmidt-Hebbel (1998) points out that the pension reform in Chile raised the national saving rate. The study argues that 31% increase in national saving could be explained by the pension reform, with the remaining being explained by other structural changes such as the tax reform. In a microeconomic study of household saving rates in Chile, Coronado (1998) finds that households who participated in the private program had higher saving rates in Chile. However, Agosin and French-Davis (2001) extend the analysis and show that the rise of saving was concentrated in the business sector, while the net change in household saving was small.

More recently, Bonasia and Napolitano (2010) have examined the pension systems of Iceland, in particular how the reforms towards multi-pillar arrangements have affected national savings. Using combinations of different econometric methodologies (SURE, ARDL) the paper provides substantial evidence that mandatory PF had a positive impact on national saving. The coefficient of private pensions on savings shifted upward soon after the launch of the reforms in 1993 and in 1998. The authors argue that the increase of inflows of capital experienced by such a small open economy (from a modest 2% in 1990 to 16% in 2002) has much to do with the reforms aimed at boosting PF.

Anton et al. (2011) analyze the effect of tax reliefs on private supplementary pensions on national saving in Spain. Using a longitudinal dataset and fixed effects methods, the study finds that such a policy measure has not significantly affected Spanish national savings.

Finally, several authors have emphasized the role of financial literacy on some relevant households' life-cycle decisions. According to Banks et al. (2007), McArdle et al. (2009), Guiso and Jappelli (2009), Jappelli, T. (2010), Van Rooj et al. (2012), and Fornero and Monticone (2011) financial literacy has implications on stock market participation, wealth accumulations and portfolio

[22] These countries are Peru (1991), Guatemala (1991), Mexico (1992), Argentina (1994), Colombia (1994), Uruguay (1996) and Bolivia (1997).

diversification. Lusardi and Mitchell (2008, 2009 and 2011) argue that less literate people are less likely to save for retirement. Jappelli and Padula (2011) analyze data for 39 countries and find that financial literacy is a determinant for the level of national savings, Klapper and Panos (2011) find that higher literacy is positively related to retirement planning and investing in private pension fund. It is sensible to presume that the effectiveness of PF in enhancing households' saving is likely to depend on the level of financial literacy of the latter. Since most recent reforms hinge on households' responsibility in choosing the optimal portfolio-composition of retirement savings, we believe that further analysis on such an issue is worth being pursued in the future.

Panel data

The use of panel databases on this topic has been very limited so far. Bailliu and Reisen (1998) work with a sample of 11 countries and a panel of more than 100 observations for years 1982-93 to study the effect of funded pension wealth as a determinant of private saving rates. They give evidence that pension asset accumulation has positive and significant impact on private savings, although to a varying degree. More precisely, while on the one hand a negative effect is witnessed in OECD countries, on the other hand they find systematic evidence that funded pension wealth increases private saving rates in developing countries when PF is mandatory in nature: the estimations reveal that the impact is 8 times larger for non-OECD countries than OECD countries.

Samwick (2000), working with a panel of five countries, finds that no country other than Chile that moved to a system based on a DC scheme during the sample period experienced an increase in the trend in savings rates after the reform. Secondly, the cross-sectional results points to a lower saving rate in countries that had PAYG systems, especially if the PAYG system covered a large portion of the population. Finally, according to the author the intergenerational allocation of the transition cost of the reforms aimed at funding the pension system is the most important element determining the effects of the regime change on saving.

Bosworth and Burtless (2004) study 11 advanced OECD countries, and argue that growth in pension and life insurance assets crowds out other forms of discretionary private savings. The paper finds substantial evidence that pension saving substitutes for other forms of private saving and the rates are different when the pension are voluntary or mandatory[23].

The study by Murphy and Musalem (2004) tests the hypothesis that pension saving might stimulate national saving. Using an unbalanced panel of 43 countries on 1980-2004 time-period, the authors divide the countries into two groups: the first one includes countries in which pension assets mainly stem from compulsory funded pension programs; the second group of countries is instead characterized by data that are the result of voluntary funded pension programs. By using OLS and 2SLS

[23] However the study has been criticized by Davis and Hu (2008) for the simplicity of the econometric model, with only few independent variables. In addition, they also argue that the model is not sufficient to capture the dynamic nature of data generating process, although the lagged independent variable of pension assets is included.

estimation methods, their findings suggest that increases in PF financial assets increase national saving only when PF scheme is the result of a mandatory pension programs.

Rezk et al. (2009) carry out an analysis of fully-funded pension regimes based on individual accounts implemented since the 1980s in six Latin American countries (Argentina, Chile, Colombia, Mexico, Peru and Uruguay), in order to ascertain whether they were conducive to increasing aggregate savings and helped to strengthen domestic stock markets. The authors assess the impact of individual accounts systems upon aggregate private savings under different scenarios such as: homogeneous and heterogeneous individuals, voluntary and compulsory contributions and both loose and tight borrowing constraints. Their theoretical analysis shows that only under mandatory contributions and operating liquidity restrictions would private savings be unambiguously increased by PF assets. The econometric estimation of coefficients to test this hypothesis shows ample support to this argument in all but one single case.[24]

[24] Except in the case of Uruguay, in which the effect of PF on savings is found to be insignificant, contribution to fully funded systems is compulsory in the other five countries.

Table 3 : Summary of main findings on pension funds and its effect on Saving

Author /Country	Periods covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Bailliu and Reisen (1997)/ Panel of 11 countries	1982-1993/ U.N's Population Statistics File and IFS data	Fully funded pensions and savings	OLS and 2SLS	Accumulation of pension fund assets has a positive and significant impact on private saving. The effect is 8 times larger for non-OECD countries than for OECD countries
Schmidt -- Hebbel (1998)/ Chile	1960-1997/ Central Bank of Chile, National Institute of Statistics	Pension Funds and Saving	OLS and 2SLS	Pension reform increased the national saving rate. 31% of the saving rate increase is explained by the conversion of PAYG pensions to fully funded DC scheme.
Samwick (2000)/ United Kingdom, Gambia, Chile, Switzerland and Papa New Guinea	2002-03 to 2008-09/ World Bank	Transition to Fully funded and Saving rate	OLS and 2SLS	Only Chile experienced an increase in saving rate while converting from a traditional PAYG scheme to fully funded DC scheme. Method of financing the reforms holds the key in the effect of saving.
Bosworth and Burtless (2004) / Japan, U.S, Canada, Australia, France, U.K and Germany	1970-2000/ OECD and Various national sources	Pension funds and National Saving	Fixed Effect Estimates	Growth in pension assets reduces crowding out other forms of voluntary saving.
Murphy and Musalem (2004)/ 43 countries both OECD an developing countries	1982-2004/ World Development Indicator& Institutional Investors Year Book	Mandatory/ Voluntary funded pensions and national saving	OLS	Pension fund and life insurance assets increase saving when they are mandatory in nature.
Rezk et al (2009)/ Argentina, Chile, Peru, Colombia, Mexico, Uruguay	1995-2006/ Various Sources	Pension funds and Saving	Fixed effect regression	If pension fund assets are mandatory and follow certain liquidity restrictions, the national savings could be increased.
Anton et al (2011)/ Spain	2002-03 to 2005-06/ Spanish survey of household finances (SSHF)	Pension Funds and Saving	Fixed effect	The effect of tax reliefs on private supplementary pensions does not increase national saving.
Bonasia and Napolitano (2010)/ Iceland	1997-2009/ IMF Financial Statistics, Iceland Central bank and OECD Statistics	Funded pensions and Saving.	SURE and Cointegration Analysis	Mandatory pension funds have positive effect on national savings.

3.2 Pension funds and capital market development

A relevant channel through which PF may affect financial efficiency is the promotion of capital markets development. Indeed, the stimulus for financial progress is the most widely acclaimed positive externality that PF schemes bring about. As a consequence, the academic literature acknowledging the importance of institutional investors' growth for financial development has argued the need for removing the barriers for free flow of capital to its fullest potential.

To summarize the main arguments on this topic, Iglesias (1997) puts an emphasis on the role of PF in diminishing the trading and issuing costs on the capital markets on which they act. Blommestein (1998) argues that the presence of an environment populated by strong institutional investors is a precondition for the development of capital markets. The same author brings evidence that no other investor category, institutional or private, matches figures in volume and duration of PF.

Another argument is that PF growth can augment capital market development by their long term planning horizon and by providing innovative investment opportunities, thus attracting and transferring resources towards more productive activities (Merton and Bodie 1995; Impavido et al. 2001; Davis 2011; Raddatz and Schmukler 2008).

PF activities are also argued to induce capital and financial market development by fostering competition in primary securities market but also in banking sector as they perform both substituting and complementary roles with other financial institutions, specifically commercial and investment banks. In this regard, Catalan et al. (2000) and Davis (2011); even uphold the argument that PF fulfill a number of the functions of the financial system more efficiently than banks or direct holdings. In addition Walker and Lefort (2002), as well as Impavido and Musalem (2000) outline the role of PF in providing incentives for increased specialization in asset management by the PF managers, leading also to improved corporate governance.

Finally, other authors argue that PF may improve financial markets efficiency through the inducement of financial innovation,[25] improvement in financial regulations, modernization in the infrastructure of securities markets, and an overall improvement in financial market efficiency and transparency (Bodie 1990; Greenwald and Stiglitz 1992).

3.2.2 Empirical Evidence

There is a wide range of empirical literature investigating the effect of PF on capital market development. Overall, we can say that such empirical works, although using various methodologies and different time period data sets, have somehow reached a consensus on the significant, positive role played by PF.

[25] Financial innovation stemming from institutional investors is claimed to be evident even in developing countries where systemic pension reforms have been implemented. Diamond and Valdes-Prieto (1994) cite the case of Chile where PF supported the development of both mortgage and corporate bond markets and have invested heavily in public sector bonds.

In fact, the empirical evidence is mostly focused on developing economies, especially on Latin American countries, which had favored the transition of pension systems to PF in late 1980s and early 1990s. Empirical results from selected emerging countries showed positive effect of PF on capital market development.

Impavido and Musalem (2000) using the methodologies of ordinary least squares, Error component and Error component Two Stage Least Squares, estimate on a panel of 26 countries including 5 developing countries and show a positive effect on stock market capitalization but not on stock value added. Catalan et al. (2000) have conducted Granger Causality tests on 14 OECD countries and 5 developing countries to see the casual relationship between stock market development and contractual saving institutions such as PF and they observe a positive effect. Walker and Lefort (2002) carry out a panel study using Generalized Least Squares Estimator (GLS) for 33 emerging markets and shown positive impact of PF on capital market development.

Impavido et al. (2003) use a dynamic panel data model to estimate the impact of contractual savings institutions on the stock market and bond market development. Using the Arellano-Bond (1991) differenced GMM estimator on 32 developed and developing countries in the time period 1998-2002, they find also that financial assets stemming from contractual savings exert a positive and significant impact on the stock market and bond market development.

Also Rocholl and Niggemann (2010) underline the fact that the structure of pension systems is an important determinant for the development of capital markets. The study employs a set of 87 pension funding reforms in 57 countries for the time period 1976-2007, and using a GLS approach discovers that funding reforms (a switch from traditional PAYG to funded pension system) have led to larger stock and corporate bond markets relative to the time before these reforms were initiated. According to the authors this was mainly possible through an increase in primary issuance activity, which accelerated along with the reforms in pension systems. The effects of these reforms were reflected in the bond and stock markets of emerging countries, while in the OECD countries the impact was restricted to corporate bond markets. Hence, the authors conclude that PF growth indirectly helps in enlarging capital markets through qualitative improvements such as financial innovation.

Various extensions of the existing relationship of PF and financial market development have been carried out aiming to unveil the market (pre)-conditions or the PF structure that may influence the size of the PF's impact on capital market development.

As for the former, several scholars argue that the effect of PF crucially depends on some institutional and economic conditions, such as the starting level of financial development (Dayoub and Lasagabaster; 2008), of shareholder protection (Pagano and Volpin; 2006), of openness to trade (La Porta et al.; 1997; Raisa; 2012) and of capital mobility (Rajan and Zingales; 1998). The argument put forward by Iglesias and Palacios (2000), whereby PF's impact is diluted to the extent to which their managed resources are used for financing government deficits or investments in inefficient projects, points to the same institutional issues. Also Vittas (2000) and Kim (2010) argue that PF will have

positive impact on capital markets only when PF reach a significant size, with lesser regulations on investment and wider portfolio selection.

As for the PF structure and investments' strategies, Raddatz and Schmukler (2008) is one of the first studies trying to understand the relationship between PF and capital market development through a microeconomic approach. Using a unique data set of on monthly asset-level portfolio allocations of Chilean PF between 1995 and 2005, the paper studies the ways through which PF affect the domestic capital market growth by analyzing at a micro level how PF invest, their strategies of trading and resulting asset allocation. The econometric evidence shows that PF in Chile tend to hold similar portfolios at the asset-class level and herd in their investment decisions. Furthermore, they trade relatively little, changing their positions very infrequently and holding assets up to maturity. The authors conclude that these investment patterns could severely affect the liquidity of capital markets. On the other hand, PF absorb a large amount of private bonds, likely allowing the corporate sector to issue that type of securities and effectively helping in the development of bond market.

Hryckiewicz (2009) evaluates the empirical link between institutional assets growth[26], institutional investments behavior and stock market performance in the developing countries and finds that institutional investors contribute to greater activity in these capital markets, especially through higher demand for the local securities induced by such institutions. In addition, the author argues that in countries where the institutional investors actively participate in the corporate governance, their presence possibly reduces the cost of capital for firms and also positively influences the stock market capitalization. Using the GMM technique on the panel of eight Central and Eastern European (CEE) developing countries over the period of 1995-2006, the study indicates that institutional development and, in particular, the presence of PF facilitated by pension reforms, exerts a robust and significant impact on the securities markets growth in the developing countries. Furthermore, the paper underlines the fact that magnitude of these effects depends on the pension scheme a country relies upon.

Kim (2010) argues that institutional conditions such as well-developed financial markets and the size of PF are crucial elements for the latter to create significant effects on capital markets. Using the data from 16 OECD countries[27] the study observes development of PF has a unilateral Granger-causality for the long-term investments in innovative activities as well as for the development of capital markets. The results for PF growth show that the latter could make the capital market (more) volatile from time to time; but they confirm the possibility that PF's growth stimulates the development of both capital markets and real economy in the long-term.

Meng and Pfau (2010) investigate the impacts of PF on the development of both stock and bond markets. The countries examined are split into two groups according to their level of financial

[26] Institutional assets are a combination of PF, insurance sector, investment fund sector. Out of this, PF grew faster than other types of institutional investors over the long-term in most of the Central and Eastern European economies.

[27] The entire sample is divided into two samples; 4 Anglo Saxon Countries including Australia, Canada, Great Britain and U.S.A, 11 Continental European countries and Japan.

development, to examine whether the impacts are only significant for countries with high financial development. For the overall sample of countries, the authors find that PF financial assets have positive impacts on stock market depth and liquidity as well as on private bond market depth. As for the short run dynamics of capital markets, the countries with well-developed financial systems generally can expect to enjoy significant benefits from the growth of their PF, while the evidence of such benefits is much less clear for countries with low financial development.

Liang and Bing (2010) use time-series data of United Kingdom[28] from 1970-2008 to conduct empirical analysis to reveal the relationship between financial-market development and the management of PF. The Granger test results imply that the PF growth has a positive effect on the deepening of financial market development. Moreover, their co-integration tests show that there is one long-run equilibrium relationship between PF growth and financial market development. The impulse response function analysis also suggests that both the capital market development and the PF investment will bring positive impacts on each other.

Finally, the results provided by Raisa (2012) also imply a positive relation between the growth of PF and capital market development, however in less intensive manner, reflected by a significance level of estimated coefficients at 10 %. Using the data from EU-15 countries[29] within the period 1994-2011, the study estimates the relationship between stock market capitalization over GDP as a proxy for stock market development and PF managed assets over GDP. The structural model, employing the EGLS estimation procedure, controls also for several variables such as the lagged dependent variable, inflation rate, long term interest rate, GDP per capita, economic freedom[30], old age dependency ratio. All the coefficients except the old age dependency-ratio are statistically significant. In line with other studies such as La Porta et al. (1997) and Rajan and Zingales (2003), which show that countries with higher incomes also tend to have deeper and better functioning capital markets, evidence of a positive connection between PF assets and stock market development is thus unearthed.

[28] The study chooses United Kingdom as it is one of the countries increasing funding by introducing an individual account system.

[29] The countries include: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and UK.

[30] The aggregate index of economic freedom includes rule of law, limited government, regulatory efficiency and open markets trade freedom, investment freedom, financial freedom. The data is obtained from Heritage, Country Overall Score.

Table 4 : Summary of main findings on pension funds and capital market development

Author / Country	Periods Covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Impavido and Musalem (2000)/ Panel of 26 countries	1960-2007/ IFS, WDI, OECD, Datastream and National Sources	Pension funds and capital market development	OLS and Error component 2SLS	Positive effect on stock market capitilization but not on stock value added.
Catalan et al (2000)/ 14 OECD countries and 5 developing markets	1960-1997/ World Bank, Institutional Investor dataset &WDI	Pension funds and capital market development	OLS and Error component 2SLS, Granger causality test	Pension fund growth granger causes stock market development.
Walker and Lefort (2002)/ 33 Emerging Market Database	1981-2000/ IFC & Emerging country database.	Pension funds and capital market development	OLS, Fixed Effect and GLS pooled estimator	Positive effect of pension fund assets on capital market development.
Impavido et al (2003)/ Panel of 32 countries (both developed and developing)	1998-2002/ WDI, IMF Financial Statistics & Bank for International Settlement for bond market data.	Pension funds and capital market development	GMM	Contractual savings institutions have positive and significant effect on stock market and bond market development.
Raddatz and Schmulker (2008)/ Chile	1995-2005/ Superintendency of PF Administrators of Chile	Pension funds and preconditions for capital market development	Herding Statistic by Lakonishok et al (1992)	The way the funds are invested determines the level of capital market development. There exists a two way relationship between PF and capital market development.
Hryckiewicz (2009)/ Panel of 8 Central and Eastern European developing economies	1995-2006/ WDI & Bank for International settlement for bond markets.	Institutional development and security market growth.	GMM	Institutional development exerts a robust and significant impact on the securities market growth in the developing countries.

Continued

Author /Country	Periods Covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Kim (2010)/ Japan, U.S, Canada, Australia, France, U.K. and Germany	1970-2000/ WDI&OECD	Pension funds and preconditions for capital market development	Fixed Effect Estimates	Development of PF has a unilateral granger causality for the long term investments in innovative activities as well as for the development of capital markets.
Meng and Phau (2010)/ 43countries both OECD and developing countries	1960-2002/ WDI, OECD, IMF, MSCI Stock Index& National Sources	Pension funds and capital market development	OLS	Growth of pension funds can influence capital market development in countries with well developed financial markets.
Liang and Bing (2010)/ U.K.	1970-2008/ U.K Statistics Database &WDI	Management of pension funds and Capital market development	Granger Causality	Both the capital market development and the pension funds investment will bring positive impact on each other.
Rocholl and Niggemann (2010)/ Panel of 57 countries	1976-2007/ WDI& OECD Private Pension Outlook	Structure of PF and capital market	SURE and Cointegration Analysis	PF growth indirectly helps in the growth of stock and bond market, while it is restricted to bond markets in OECD markets.
Raisa (2012)/ EU-15	1994-2011/ WDI, OECD, WB, Datastream, Eurostat, ECB and Heritage Score	Pension funds and capital market development	OLS and EGLS	Positive relation between the growth of PF and capital market development however in less intensive manner.

3.3 Pension funds and Economic Growth

As for the empirical literature on the effects of PF on economic growth, Holzmann (1997) finds a positive relationship between pension reform and economic growth in Chile. With the simple Solow residual specification of TFP, the author finds that the improved financial market conditions following the pension reform affected Total Factor Productivity (TFP) significantly and positively.

Meanwhile, Schmidt-Hebbel (1998) reaches the conclusion that pension reform in Chile boosted private investment, the average productivity of capital and TFP. More precisely, the study concludes that the pension reform contributed to 0.1 to 0.4 per cent of the 1.5 per cent increase in TFP growth rate while 0.4 to 1.5 per cent of the total 13 per cent rise in private investment rate is attributed to pension reforms with the remainder being explained by other structural reforms.

As for cross country studies, Davis (2004) undertakes a macro analysis using data on share of equities held by PF and life insurers in domestic markets to examine its effect on productivity, proxied by TFP, of 16 OECD countries. Using a standard Levine-Zervos (1998) specification for finance and growth, the author does not find a positive direct link between institutionalization (rising life insurance and pension assets over GDP) and GDP growth. Reverse causality is weaker, and notably for emerging markets there is no strong evidence that GDP growth homogenously causes pension assets.

On the other hand, Hu (2005) finds positive and significant effect of PF on economic growth. The study splits 38 countries into two groups: OECD and Emerging Economies and finds that irrespective of the classification **(**whether OECD or Emerging countries**)** PF assets granger cause growth. Separate regressions to ascertain whether PF assets are good indicators of growth and productivity are carried out and the results show that the ratio PF-managed-assets/GDP, the proxy used for PF development, is a good predictor of economic growth.

Davis and Hu (2008) study a panel of 38 countries (comprising of 18 OECD and 20 Emerging Market Economies, EMEs), using a modified Cobb-Douglas production model with pension assets as a shift factor. After experimenting with a range of different econometric specifications (Dynamic Ordinary Least Square, Dynamic heterogeneous model with ARDL specification, Johansen, and GMM), they find that the pension assets to GDP ratio affects positively and significantly output per head. Such effects are consistently larger for EMEs than for OECD countries, thus indicating catch-up effects featuring economic development.

Zandberg and Spierdijk (2010) find no evidence that funding of pensions leads to higher economic growth, neither in OECD countries nor in non-OECD countries. The study firstly identifies that the amount of pension assets in a country is mainly driven by two factors, namely capital market returns of PF and demographic changes. In fact, when controlling for these two variables (which were not taken care of in the other studies) in the regression equation, they observe no relationship between funding of pensions and economic growth.

Finally, Islam and Osman (2011) utilize co-integration and error correction mechanism to test the causal relationship between the development of non-bank financial intermediaries (NBFIs) which include PF, and per capita economic growth in Malaysia over the period 1974-2004. Data are obtained from the Annual Reports (various issues) of the Central Bank of Malaysia (BNM), published sources of the individual NBFIs and International Financial Statistics (IFS). The results show evidence of a unique long-run causality running from non-bank financial intermediaries to per capita economic growth, but not the vice versa. The empirical evidence suggests that the financial development indicator in the form of NBFIs are in part responsible for the change in the per capita real GDP in Malaysia.

Table 5: Summary of studies in pension funds and economic growth

Author / Country	Periods Covered /Data Source	Topics Investigated	Methodology Used	Major Findings
Schmidt- Hebbel (1999)/ Chile	1960- 1997/ Central Bank of Chile & National Statistical Institute	Pension Funds and GDP growth	OLS and 2SLS	A positive impact of reforms is witnessed on growth indicators. The pension reform significantly boosted private invested, average productivity of capital and TFP.
Davis (2004)/ 16 OECD Countries	1996 to 2002 / WDI & World Bank	Institutional Investors and growth. Both PF and Life insurance are covered	Levin- Zeros Specification Model	There is no positive and direct linkage between institutional investors and productivity proxied by TFP. Reverse causality is weaker, implying no evidence that GDP growth homogenously causes growth in pension fund assets
Hu (2005)/ Panel of 38 countries, both OECD and EME	1981 to 2000 / WDI & Financial Structure and Economic Development Database	Pension reform and TFP growth and pension assets and TFP growth.	Panel Contemporaneous regressions and Panel Granger Causality tests	Pension funds granger cause economic growth in both OECD and Emerging country database.
Davis and Hu (2008)/ Panel of 38 countries both OECD and EME	Unbalanced Panel from 1980-2003/ OECD, FIAP, WDI& Various National Sources	Pension funds and GDP growth	Dynamic OLS	Pension assets / GDP ratio affects output per head, both significantly and statistically.
Zandberg and Spierdijk (2010)/ Panel of OECD and non-OECD countries	2001-08/ WDI, OECD; Barclays Capital Global Aggregate Bond Index &MSCI	Funding of pensions and economic growth	Bias Corrected LSDV Estimator	Funding of pensions does not cause economic growth in neither OECD& non - OECD countries. Differently from above studies, capital market returns of pension funds and demographic changes are controlled in this exercise.
Islam and Osman (2012)/ Malaysia	1974-2004/ Central Bank of Malaysia, ADB, IFS and Individual NBFIs.	NBFI including PF and Per capita GDP	ARDL bound test for Cointegration	Long run causality exists between NBFI(PF) and per capita GDP growth but not vice versa

4. Conclusions

The numerous empirical and theoretical studies that have been published in the last three decades all added pieces of evidence, although to different extent, of the relevance of pension funds in enhancing market efficiency, covering both labor and financial markets.

The aim of the present work has been to uncover stylized facts that hold over space and time that can, on the one hand, inspire theoretical models that are based on reasonable assumptions and, on the other hand, inform policy debates in an evidence-based way. Although a substantial variation of results across studies on some specific aspect did emerge, we can try to summarize what appears as a consolidated evidence so far and what, in our view, needs further investigation.

Summarizing from the literature on pension funds and job mobility, it seems fair to conclude that pension coverage per se, either under DC or DB schemes, is not capable to affect significantly job mobility. More precisely, on the one hand the presence of portable pension rights associated with occupational, DC pension plans is found to be as negatively correlated to job mobility as the presence of rather non portable, DB pension rights. However most of the studies uphold the view of compensation premium, better jobs and self-selection as the determinants of lower turnover rates in pension covered jobs.

Whether such lower turnover rates are detrimental or not to economic efficiency is a different matter, which requires further theoretical and empirical research in the future. Moreover, most works have focused on Anglo-Saxon or Latin-American countries. We believe that further investigation should be carried out for EU countries, in which several reforms have been introduced quite recently and the concern for pension-rights portability and for the freedom of movement of workers across EU member countries is on the agenda of the European Commission.

The empirical literature on fully funded pension funds and their effects on job-participation and retirement choices is relatively sparse. However, the

existing contributions tend to confirm the theoretical prediction that labor supply is a life-cycle decision taken by farsighted individuals, endowed with a certain degree of rationality and that the choice of the age of retirement is the solution to the workers' optimisation problem concerning the trade-off between leisure and consumption over the life-cycle. Studies show that such a choice process is significantly affected by the incentives/losses embedded in the pension-benefit formula. In this respect the conclusion that actuarially fair, DC pension fund can improve labor force participation of older workers is a largely shared and consolidated view. However, most of the existing studies consist of simulations. Therefore, more empirical work on the relative advantage that DC pension funds can represent for labor market efficiency is necessary to further consolidate results.

As for the effects of pension funds on financial markets efficiency, we can say that while there is conclusive evidence of significant influence of the former on capital market development, conclusions are more mixed on the issue of saving and economic growth.

More precisely, as for savings, first of all it emerged that the introduction or the development of pension funds (compared to PAYG schemes) has been effective in increasing savings, either private and national, mostly under mandatory programs and in developing countries, where binding financial constraints are more likely to occur. In general the effect of pension funds may change, depending on various institutional factors like the type of the program, the structure of incentives such as tax relief programs and so on.

Second, there has been evidence that additional savings earned by the deployment of mandatory funded pension programs were aiding in strengthening the domestic capital markets, although some institutional aspects such as the size and structure of pension funds, the level of financial development also do matter for the intensity of such an effect.

On this respect, in the light of the argument that the level of financial literacy of workers has been found to influence their financial decisions including stock market participation, saving and retirement planning, we believe that the increasing literature on financial literacy can be particularly

useful in further unveiling the determinants of pension funds effectiveness in increasing households' savings.

Thirdly, there is rather consolidated empirical evidence that pension-fund-aided financial development translated into economic growth. The development of financial institutions such as pension funds has been found to be an important locomotive for promoting economic growth particularly through providing long term financing to productive investment activities in those countries where the financing activities of the conventional banking system are mostly limited. More in general, the development of non-bank financial-institutions is found to promote the development of small and medium-sized industries which have no or limited opportunities to access to the stock market and the commercial banks to meet their financial needs.

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